

Process	Kalman filter (KF)	Extended Kalman filter (EKF)	Unscented Kalman filter (UKF)
Prediction  (Time update)	$\bar{\mathbf{x}} = \mathbf{F}\mathbf{x} + \mathbf{B}\mathbf{u}$  $\bar{\mathbf{P}} = \mathbf{F}\mathbf{P}\mathbf{F}^\top + \mathbf{Q}$	$\bar{\mathbf{x}} = f(\mathbf{x}, \mathbf{u}), \mathbf{F} = \left. \frac{\partial f(\mathbf{x}_t, \mathbf{u}_t)}{\partial \mathbf{x}} \right _{\mathbf{x}_t, \mathbf{u}_t}$  $\bar{\mathbf{P}} = \mathbf{F}\mathbf{P}\mathbf{F}^\top + \mathbf{Q}$	$\bar{\mathbf{x}} = \sum w^m \boldsymbol{\mathcal{Y}}, \boldsymbol{\mathcal{Y}} = f(\boldsymbol{\chi})$  $\bar{\mathbf{P}} = \sum w^c (\boldsymbol{\mathcal{Y}} - \bar{\mathbf{x}})(\boldsymbol{\mathcal{Y}} - \bar{\mathbf{x}})^\top + \mathbf{Q}$
Update  (Measurement update)	$\mathbf{y} = \mathbf{z} - \mathbf{H}\bar{\mathbf{x}}$  $\mathbf{S} = \mathbf{H}\bar{\mathbf{P}}\mathbf{H}^\top + \mathbf{R}$ $\mathbf{K} = \bar{\mathbf{P}}\mathbf{H}^\top \mathbf{S}^{-1}$ $\mathbf{x} = \bar{\mathbf{x}} + \mathbf{K}\mathbf{y}$ $\mathbf{P} = (\mathbf{I} - \mathbf{K}\mathbf{H})\bar{\mathbf{P}}$	$\mathbf{y} = \mathbf{z} - h(\bar{\mathbf{x}}), \mathbf{H} = \left. \frac{\partial h(\bar{\mathbf{x}}_t)}{\partial \bar{\mathbf{x}}} \right _{\bar{\mathbf{x}}_t}$  $\mathbf{S} = \mathbf{H}\bar{\mathbf{P}}\mathbf{H}^\top + \mathbf{R}$ $\mathbf{K} = \bar{\mathbf{P}}\mathbf{H}^\top \mathbf{S}^{-1}$ $\mathbf{x} = \bar{\mathbf{x}} + \mathbf{K}\mathbf{y}$ $\mathbf{P} = (\mathbf{I} - \mathbf{K}\mathbf{H})\bar{\mathbf{P}}$	$\boldsymbol{\mu}_z = \sum w^m \boldsymbol{\mathcal{Z}}, \boldsymbol{\mathcal{Z}} = h(\boldsymbol{\mathcal{Y}})$  $\mathbf{y} = \mathbf{z} - \boldsymbol{\mu}_z$  $\mathbf{P}_z = \sum w^c (\boldsymbol{\mathcal{Z}} - \boldsymbol{\mu}_z)(\boldsymbol{\mathcal{Z}} - \boldsymbol{\mu}_z)^\top + \mathbf{R}$ $\mathbf{K} = \left[ \sum w^c (\boldsymbol{\mathcal{Y}} - \bar{\mathbf{x}})(\boldsymbol{\mathcal{Z}} - \boldsymbol{\mu}_z)^\top \right] \mathbf{P}_z^{-1}$ $\mathbf{x} = \bar{\mathbf{x}} + \mathbf{K}\mathbf{y}$ $\mathbf{P} = \bar{\mathbf{P}} - \mathbf{K}\mathbf{P}_z\mathbf{K}^\top$